



Wind Projects for Iowa Schools



Colorado Wind and Distributed Energy Renewables for Rural Prosperity

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Doubletree Hotel
Colorado Springs, CO

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Iowa Has Eight Schools with Wind Turbines!



750 and 250 kW Wind Turbines at Spirit Lake Schools in 2002 & 1993

- ⌘ No other state has this many schools with wind turbines
 - ☑ Ten turbines ranging in size from 50 kW to 750 kW, with a total capacity of 3.6 MW
- ⌘ Why Iowa?
- ⌘ What are the primary factors that make it economical for schools to install a wind turbine?

Why Iowa?



600 kW Wind Turbine at
Forest City Schools in 1998

- ⌘ Good wind resources
- ⌘ State laws favorable to wind generation
- ⌘ State programs encourage energy efficiency and renewable energy
- ⌘ Leaders have demonstrated success
- ⌘ Synergism of these factors.

Six Factors Determine Feasibility



- 1) Good wind resources
- 2) Net billing with high capacity limits
- 3) State programs
- 4) Cost of power from utility is not too low and no demand charges
- 5) High electricity usage levels allow larger wind turbines and better economics
- 6) Availability of nearby suitable site.

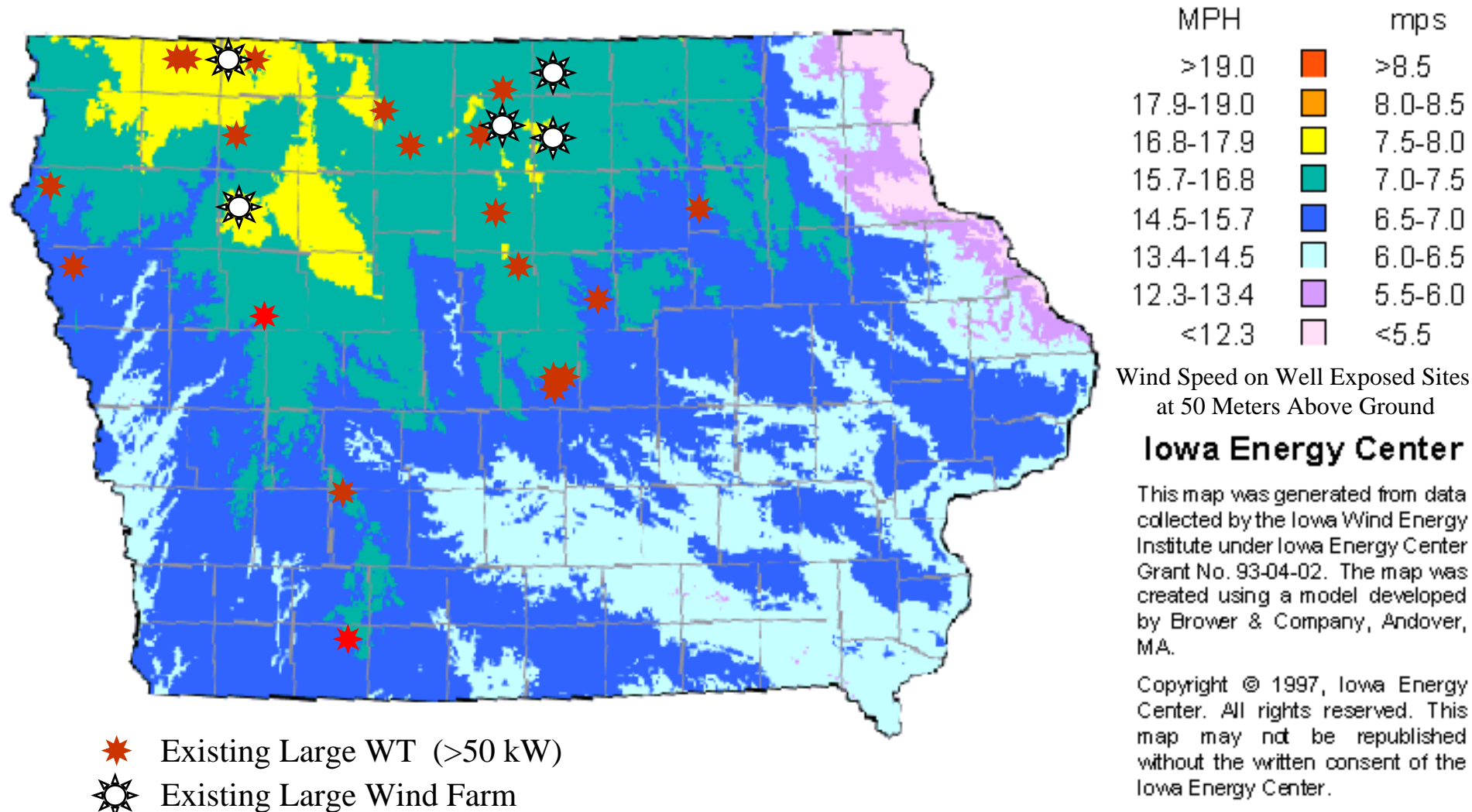
1) Iowa Has Good Wind Resources!



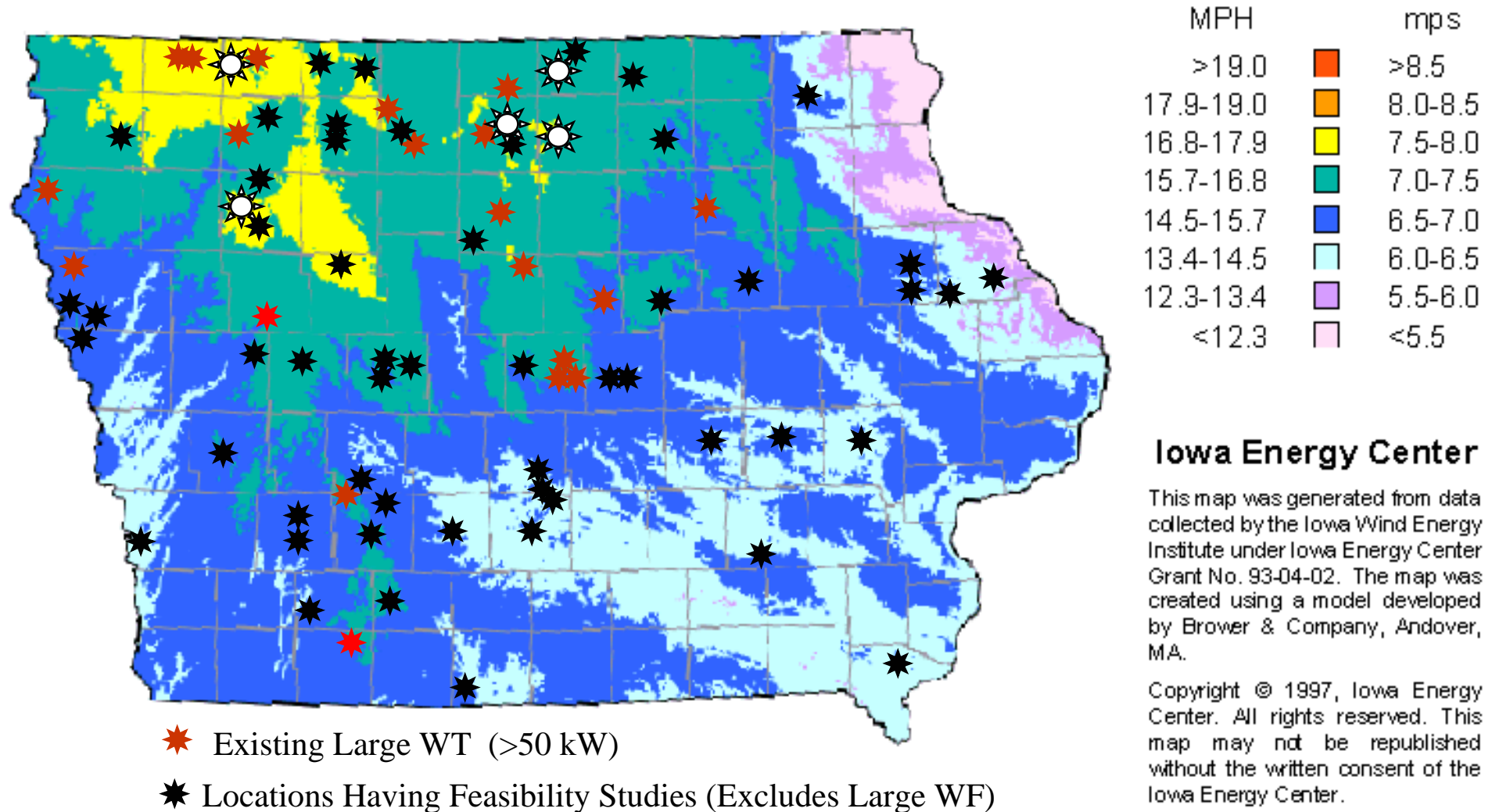
95 kW Wind Turbine in 1996 at
Clay-Central Schools at Royal Iowa

- ⌘ Iowa has 10th best wind of the 50 states
- ⌘ 40% of Iowa has wind adequate to generate electricity economically some day
- ⌘ Wind energy potential is 10 times Iowa's current electrical use.

Existing Wind Turbine Locations and Estimated Average Annual Wind Speeds On Well Exposed Sites at 50 Meters Above Ground



Other Proposed Project Locations for Which We Have Completed Wind Generation Feasibility Studies



Iowa Energy Center, 2521 Elwood Drive, Suite 124, Ames, IA 50010-8263 Phone: (515) 294-8819 Fax: (515) 294-9912

2) Iowa Has State Laws Favorable for Wind Generation



750 kW Wind Turbine in 2002 at
Eldora-New Providence High School

- ⌘ Net Billing for renewable energy systems mandated for investor-owned utilities
- ⌘ Initially unlimited in size of wind turbine
- ⌘ Utilities can recover lost revenues from net billing in their rates.

3) Iowa Has State Programs Encouraging Renewable Energy



600 kW Wind Turbine in 1998 at Akron-West Field Schools

⌘ Iowa Energy Bank Program

- ☑ Staff works with schools and local government entities on projects to ensure proper evaluation and implementation
- ☑ Low interest loans arranged

⌘ Revolving Loan Program

- ☑ Once approved, zero interest loan for 50% of cost, or \$250,000 maximum.

4) Cost of Power From Utility Is Not Too Low and No Demand Charges



65 kW Refurbished Wind Turbine in 1994
at Sentral Schools Football Field at Fenton, Iowa

- ⌘ Energy savings must typically be 6-7¢ per kWh or higher for large wind turbine
- ⌘ Single part rate with no demand charges
 - ☒ Wind turbines don't reduce demand charges very much
- ⌘ Some tariffs in state meet these two requirements.

5) High Electricity Usage Levels Allow Larger Wind Turbines



250 kW Wind Turbine
At Nevada Schools

- ⌘ Large turbines (660 kW+) produce lower cost power
 - ☑ Need school to use about 0.75 million kWh per year or more for this size of wind turbine
 - ☑ Average school in Iowa uses less than 0.75 million kWh, but many over this level
- ⌘ Lower usage levels require smaller wind turbines
 - ☑ Fewer wind turbine options
 - ☑ Delivered cost per kWh is higher, less competitive.

Wind Turbine Size Options



⌘ Large - 660 – 950 kW

- ☒ 4 models from Vestas & NEG-Micon
- ☒ Annual output: 1.5 – 2.6 million kWh
- ☒ Typically \$1,000 - \$1,300 per kW, with cost of energy of 4-5¢ per kWh in Iowa

⌘ Midsize - 250 kW

- ☒ 2 models from Norwin & Fuhrlander
- ☒ Annual output: 0.35 – 0.5 million kWh
- ☒ Typically \$1,300 - \$1,700 per kW, with cost of energy of 6-8¢ per kWh in Iowa.

Wind Turbine Size Options

(continued)



⌘ Small - 50 – 100 kW

- ☒ 3 models from Fuhrlander, Atlantic Orient, Bergey
- ☒ Annual output from 75,000 – 175,000 kWh
- ☒ Typically \$2,000 per kW, with cost of energy of 8+¢ per kWh in Iowa

⌘ Refurbished – 50 – 100 KW

- ☒ 2 models typically available from WindMatic 65 kW, NEG-Micon 108 kW
- ☒ Larger models may become available from California
- ☒ Typically \$600+ per kW, with cost of energy of 6-8¢ per kWh in Iowa.

6) Availability of Nearby Site



- ⌘ Larger wind turbines require more setback for noise and safety
- ⌘ If schools are by residential areas, may not adequate room
 - ☒ May connect to utility grid rather than behind school meter.

750 kW Wind Turbine Very Near Residential Area in Spirit Lake

Wind Turbine Economics

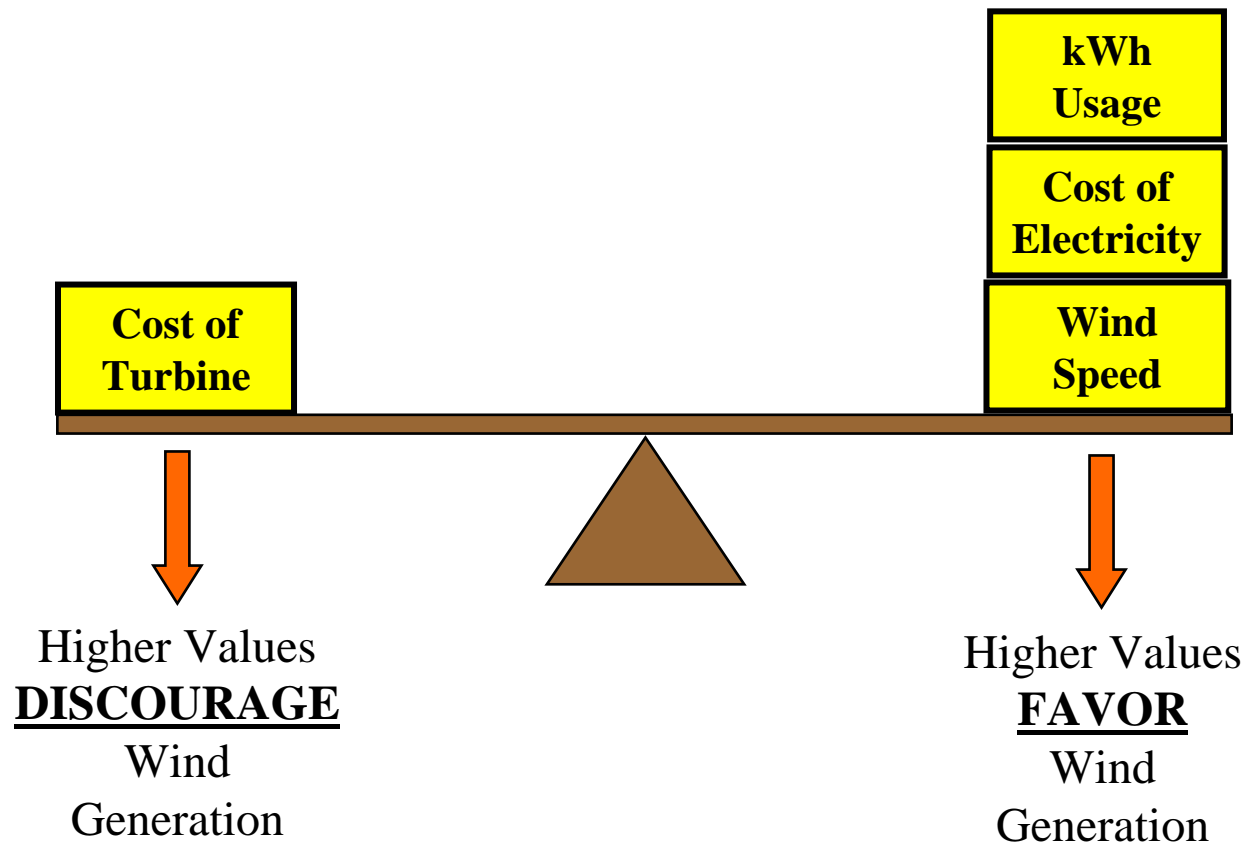


50 kW Wind Turbine at
Clarion-Goldfield Schools

Major Factors Influencing Economics:

- ⌘ Net Billing
- ⌘ Power bill savings in cents per kWh
- ⌘ Structure of power bill (single part vs. two part rates)
- ⌘ Wind speed
- ⌘ Annual kWh consumption at school or facility.

Economics of Wind Generation is Determined by Balance of Factors



Example for School #1



General Information

- Annual usage: 930,000 kWh
- Average wind speed: 16.6 mph
- Wind turbine: 750 kW
- Capital cost: \$775,000
- Annual generation: 1,975,000 kWh.

Example for School #1

Construction Cost for One 750 kW Wind Turbine					
Turbine Cost Installed					\$675,000
Interconnection					\$20,000
(UG, fused disc., phone, less Xfrm)					
Instrumentation, Phone Lines, Equip.					\$2,500
Access Road					\$2,000
Engineering, Construction, Project					
Management, Commissioning					\$35,000
Contingencies		5.0%			\$36,975

Total Project Construction Cost					\$776,475

Example for School #1



Annual Expenses

- Principal & Interest: \$80,501
- Operation & Maintenance,
Insurance, land lease (?) \$17,710
- Equipment reserve fund: \$5,800.

Example for School #1



Utility bill savings

- Annual power bill savings: \$77,700

Other Income - (with net billing)

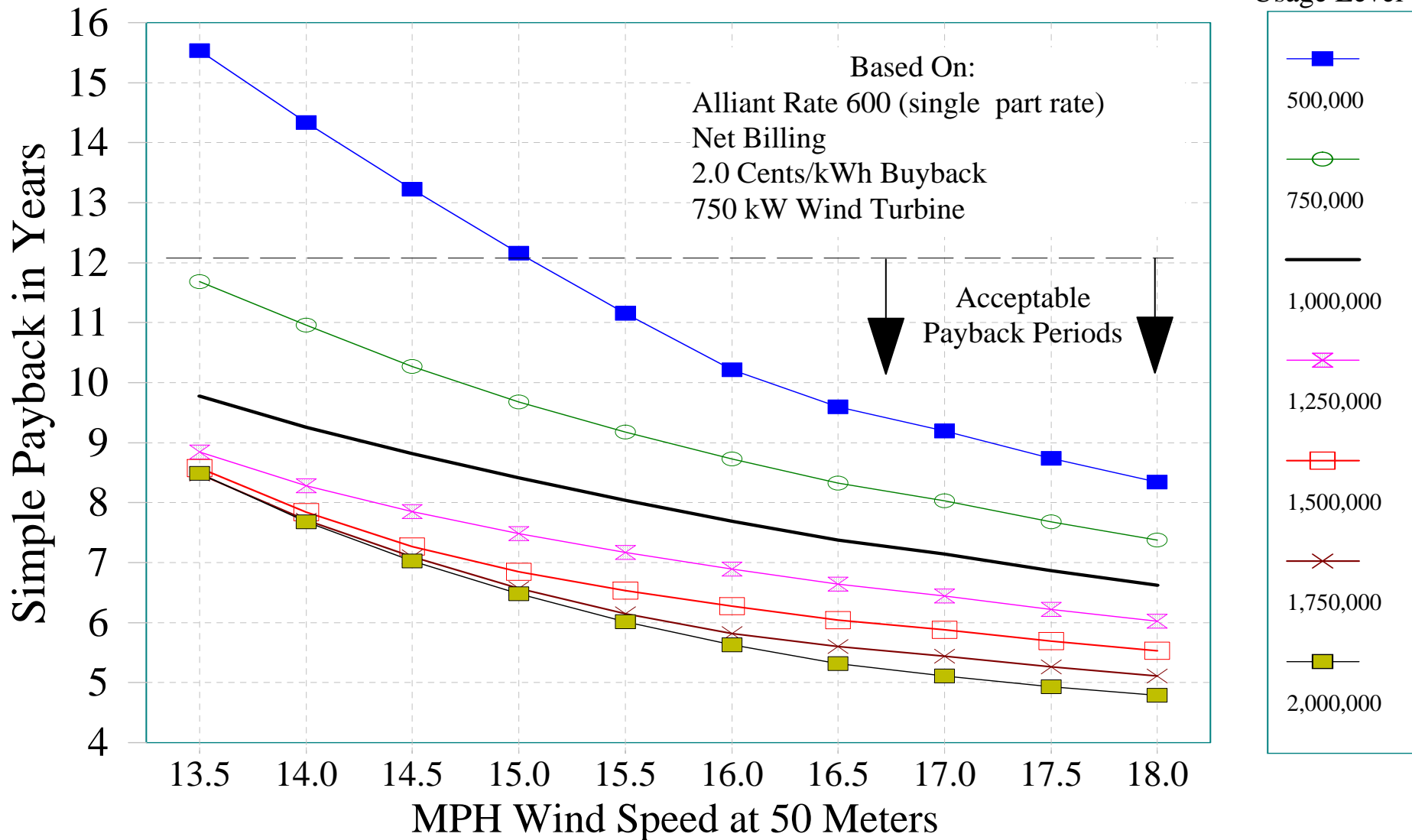
- Sales revenue from utility: \$20,700
- Revenue from REPI: \$18,200.

Example for School #1

Results

Payback in Years		
Simple	With Interest	
8	11	With Net Billing, With REPI
10	17	With Net Billing, NO REPI
10	20	No Net Billing, With REPI
14	>25	No Net Billing, NO REPI

Approx. Simple Payback Vs. Wind Speed For Various Annual kWh Usage Levels



Example for School #2



General Information

- Based on MidAmerican tariff APN
- Annual usage: 6,600,000 kWh
- Average wind speed: 17.8 mph (65 meter height)
- Wind turbine: 900 kW
- Capital cost: \$950,000
- Annual generation: 2,700,000 kWh.

Example for School #2

Construction Cost for One 900 kW Wind Turbine

Turbine Cost Installed			\$832,500
Interconnection (UG, fused disc., phone, less Xfrm)			\$20,000
Instrumentation, Phone Lines, Equip.			\$2,500
Access Road			\$15,000
Engineering, Construction, Project Management, Commissioning			\$35,000
Contingencies	5.0%		\$45,375

Total Project Construction Cost			\$952,875

Example for School #2



Annual Expenses

- Principal & Interest: \$99,000
- Operation & Maintenance,
Insurance, land lease (?) \$22,000
- Equipment reserve fund: \$7,000.

Example for School #2



Utility bill savings

- Annual power bill savings: \$92,000

Income-(with net billing)

- Sales revenue from utility: \$0
- Revenue from REPI: \$0.

Example for School #2

Breakeven-(with net billing)

Simple Payback in Years	
12	With Net Billing, With REPI
12	With Net Billing, NO REPI
12	No Net Billing, With REPI
13	No Net Billing, NO REPI

Summary of What Makes Wind Generation Feasible for Schools



School Children Visiting 3-750 kW
Wind Turbines At Algona, Iowa

⌘ Public Policy

- ⌘ Net Billing allowing large wind turbines
- ⌘ State programs encouraging renewable energy

⌘ Average or above average cost of electricity

⌘ Single part rate schedule (no demand charges)

⌘ Higher kWh usage levels

⌘ Good wind resources.

The Results

